



SAWTOOTH FISH HATCHERY

**1990 Chinook Brood Year Report
1991 Steelhead Brood Year Report**



by

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1990 SPRING CHINOOK SALMON

ABSTRACT

The Sawtooth trap and weir were put into operation on May 21, 1990 and operated through September 14, 1990. A total of 1,488 spring chinook (873 males, 503 females, 112 jacks) were trapped, with 615 fish (390 males, 167 females and 58 jacks) released above the weir to spawn naturally. Prespawning mortality of ponded fish totaled 26 and included 9 males, 14 females, and 3 jacks for a 3.0% prespawning mortality rate.

Spawning began on July 27 and continued through September 14, with 14 spawning days total. We spawned 318 females and 321 males for 1,431,360 green eggs (4,501 eggs per female), which yielded 1,346,350 eyed eggs for an eye-up percentage of 94.06%. From these eyed eggs, 1,316,048 fry were ponded, which were reared until release, resulting in a Sawtooth release of 1,273,400 spring chinook (1,496 released in September 1991 and 1,271,904 released in March 1992).

The East Fork Satellite fish trap and velocity barrier were put into operation on June 4, 1990 and was operated through September 14, 1990. A total of 145 spring chinook (103 males, 30 females, 12 jacks) were trapped with 88 fish (71 males, 10 females, and 7 jacks) being released to spawn naturally. Prespawning mortality included one female and one male for a 3.5% prespawning mortality rate.

Spawning at the East Fork started August 10 and continued through September 6, 1990, with seven spawning days total. A total of 36 males and 18 females were spawned, yielding 98,560 green eggs or 5,576 eggs per female. These green eggs resulted in 90,010 eyed eggs for an eye-up percentage of 91.33%. From these eyed eggs, we ponded 88,190 fry that were reared at Sawtooth, with 79,300 smolts hauled back to the East Fork in March, 1992.

In June and July of 1990, we received 403,500 spring chinook fingerlings from Rapid River Hatchery that were in excess of their production needs. These fish were used to fill stocking requests for the Yankee Fork of the Salmon River, with 50,500 stocked on June 18. The remaining fingerlings were reared throughout the summer and stocked as presmolts in September and totaled 303,800 fish.

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INTRODUCTION

Funding Source

Sawtooth Fish Hatchery is part of the Lower Snake River Compensation Plan (LSRCP) and has been in operation since 1985. The hatchery and satellite facility was built by the Corp of Engineers and is funded through the U.S. Fish and Wildlife Service.

Location

Sawtooth Hatchery is located five miles south of the town of Stanley, with its 71 acres bordering the Salmon River to the west, Highway 75 to the east, and Forest Service ground to the south and north. The Sawtooth weir is roughly 400 miles from Lower Granite Dam and 900 miles from the mouth of the Columbia River. Steelhead and chinook are released directly into the river from the hatchery.

Sawtooth Hatchery has operated a satellite facility on the East Fork of the Salmon River since 1984. It is 18 miles from its confluence with the main Salmon River, and that confluence is 42 miles downriver from Sawtooth Hatchery. The property was purchased from the Bureau of Land Management and is surrounded by private land. An access road easement was purchased from a private landowner who has property surrounding the location. The east side of the property borders the East Fork of the Salmon River. Historically, all East Fork chinook have been returned to the East Fork.

Species Reared

Sawtooth Hatchery is involved in trapping, spawning, and rearing spring chinook salmon to the smolt stage for release. We also trap, spawn, and incubate to eye-up "A" run steelhead and transfer their eggs to other facilities.

The East Fork facility handles spring chinook as well as "B" run steelhead. All fish are trapped and spawned and the eggs are transferred to Sawtooth Hatchery for rearing.

Broodstock History

Historically, all of Sawtooth's and East Fork's brood sources have come from the upper Salmon River and East Fork, respectively. There was some introduction of Rapid River stock at the Sawtooth site and in the headwaters of the Salmon River in the late 1970s and early 1980s as fry and smolt plants, but survival was poor and is believed not to have had an affect on our current broodstock. At both facilities, some fish are released to spawn naturally. At Sawtooth, about one-third of the steelhead and salmon are released, while one-half are released at the East Fork. An historical synopsis of releases and returns is shown in Appendix D.

Both facilities have been relatively disease-free, although Sawtooth and East Fork chinook have had a high incidence of BRD and a minor incidence of whirling disease. The incidence of BKD is being reduced by feeding and injecting erythromycin and by segregating high BKD parents' progeny from the rest of the population. This segregation starts at the eye-up stage and continues until

release (smolt stage). Whirling disease is reduced by keeping the fry on well water for as long as possible before moving them outside on river water (See Fish Health section for more information).

OBJECTIVES

Mitigation Goals

As part of the Lower Snake River Compensation Plan, Sawtooth's mitigation goals are expressed in adult returns over Lower Granite Dam. This goal is 19,000 adults.

Idaho Fish and Game Objectives

Idaho Fish and Games' objectives are:

1. To produce 2.4 million smolts for release, of which up to one million of the East Fork-origin smolts will be returned to the East Fork of the Salmon River.
2. Produce quality fish for supplementation programs.
3. Implement research programs at the hatchery to improve the returns to the hatchery.

FACILITY DESCRIPTION

Hatchery Description

Sawtooth Hatchery is located five miles south of Stanley, Idaho, in the Sawtooth National Recreation Area and occupies 71 acres of ground at an elevation of 6,480 feet. The landscaping and construction was done to minimize the impacts upon the natural environment.

The hatchery's main building is 134 ft by 166 ft and consists of an office, meeting room, lab, visitor/interpretive center, wood shop, welding/fabrication shop, intake collection box/chemical room, shop office, incubation and early rearing room, one inside storage room and two outside covered storage areas, generator room, furnace room, and a feed freezer/chemical equipment room. The hatchery has four pump houses (each is 14 ft x 11 ft), of which one is for domestic water and three are production wells. An intake building (15 ft x 37 ft) is located one-half mile upstream from the hatchery, and Salmon River water is collected for outside production rearing. The temporary employee dorm and adult spawning facility are located 300 yards downstream of the hatchery building. The dorm (38 ft x 72 ft) has three bedrooms with a bath in each, attached public rest-room facilities, storage and laundry room, living and dining room with an open kitchen. It can sleep 12 people. The adult facility consists of three adult ponds and an enclosed spawning shed (35 ft x 52 ft). There are five resident houses at Sawtooth, all about 1,360 square feet with attached single car garages and separate wood sheds.

The East Fork has a roof structure over a 28 ft travel trailer that is used as a residence while the trap is in operation. The other building is a combination shop, storage and spawning shed (22 ft x 44 ft).

Production Capacities

Production capacities at the East Fork trap consists of two 68 ft x 10 ft x 4.5 ft adult holding ponds (3,060 cubic ft) and a 10 ft x 17 ft fish trap. No fish rearing is done at this facility, and all eggs taken during spawning are shipped to Sawtooth.

Production capacities for Sawtooth include 100 stacks of FAL incubators containing 800 trays. These trays can handle up to five million chinook or 7 million steelhead eggs. We have 16 inside rearing vats that can be split into three sections, with a total volume of 480 cubic feet and a capacity for 100,000 fry each. Our outside rearing consists of 12 fry raceways with 750 cubic feet of rearing space each and 28 production raceways with 2,700 cubic feet of rearing space each. Each production raceway has a capacity to raise 100,000 chinook to smolt stage, which gives us a total capacity of 2.8 million fish (this number might be cut by 40% given the recently completed density studies). These production raceways are serial reuse that flow from an upper raceway to a lower one. The adult facility has three concrete holding ponds with 4,500 cubic feet of holding area. Each pond can hold approximately 1,300 adults.

RECOMMENDATIONS

Some recommendations for Sawtooth Hatchery would include more usable well water for outside rearing to cool summer water temperatures and to provide emergency rearing water during the winter. A separate river water source is needed for the adult holding ponds. The current water source is mostly reuse from the raceways and settling ponds and has a tendency to be higher in temperature than the river temperature during adult spring chinook holding.

The only East Fork recommendation would be the construction of separate holding ponds for smolt acclimation.

WATER SUPPLY

Source

Sawtooth Hatchery receives water from the Salmon River and three production wells. Rearing water from the river enters an intake structure located one-half mile upstream from the hatchery building, and flows through a 54-inch pipe to a control box located in the hatchery building where final screening is accomplished. These screens have been switched for smaller ones that will pass salmon fry in the spring more easily. Water is then distributed to the indoor vats, outside raceways, or adult fish facility.

Incubation water is provided by two production wells or river water, but because of the problem of introducing whirling disease to the vats when using river water, this practice was stopped three years ago. Excess well water is spilled back into the control box for use in the outside raceways.

The East Fork trapping site receives water from the East Fork of the Salmon River via gravity-flow piping throughout the holding ponds. No fish are reared at this facility.

Quantity and Temperature

The wells provide 7.8 cfs of pumped water and temperatures range from 39°F (4°C) in the winter to 52°F (11°C) in the summer (Appendix G). The river provides up to 55 cfs of gravity-flow water and ranges in temperature from 32°F (0°C) in the winter to 68°F (20°C) in the summer.

Water Quality

The last water quality analysis from the collection box at the river was completed on September 10, 1985. It was analyzed again recently; the results will be included in next years brood year report. Results from 1985 include Hardness at 62 (mg/L); Total Alkalinity as CaCO₃ at 63; Bicarbonate Alkalinity as CaCO₃ at 63; Sp. Conductance (umhos/cm) at 135; Total Ammonia as N at 0.045 (mg/L); Total NO₂+NO₃ as N at 0.088; Total Kjeldahl Nitrogen as N at 0.26; Total Phosphorus as P at 0.02; Ortho Phosphorus as P at <.003; and pH at 8.1. Additional information is shown in Appendix H.

STAFFING

Five permanent personnel are present at Sawtooth Fish Hatchery: a Fish Hatchery Superintendent III, Joe Chapman; a Fish Hatchery Superintendent I, Phil Coonts; a Utility Craftsman, Jim Nixon; and two Fish Culturists, Bill Stutz and Steve Wingert.

The hatchery has 8 months of fishery technician time, 42 months of bio-aide time, and 27 months of laborer time.

FISH HEALTH

Several programs that will be implemented in the near future at Sawtooth Hatchery, such as baffles and shade for the outside raceways. A BKD segregation program was implemented at this hatchery in 1989, with apparent success in limiting mortalities to high BKD raceways (1991-153 fish and 1991-154 fish).

Important pathogens found at Sawtooth Hatchery are Renibacterium salmoninarum (BKD), Myxobolus cerebralis (whirling disease), Diplostomum spp. (eye fluke), and Flexibacter psychrophilus (Cold Water Disease). Both Myxobolus and Diplostomum have been controlled with concrete raceways. Although Flexibacter is ubiquitous in the environment, Cold Water Disease is not expressed at this hatchery unless stressful conditions predispose the fish to disease. In times of warm water temperatures or handling, some fish will show the typical signs of this disease. The focus of the fish health program at Sawtooth is control of BKD.

In 1991, strict enforcement of the erythromycin INAD restricted medicated feed treatments to 14 days. This protocol was not completely effective in controlling BKD at this station. In the future, the protocols stated in the INAD

4333 for Sawtooth Hatchery call for 21-day treatments for production fish and 28-day treatments for high BRD segregation groups. In the future, erythromycin feeding strategies will include protocols which might enhance absorption of the drug.

Although the well at Sawtooth Hatchery is sufficient for early rearing (indoor raceways), supplemental wells are needed to supply 50°F plus water to keep the water intake free of ice in the winter. Furthermore, during the summer, river water temperatures reach 70°F. Cool water could be mixed with river water to maintain optimum rearing temperatures. The results of disease sampling are shown in Table 1.

FISH PRODUCTION

Spring Chinook Adult Collection

The chinook trapping season began on May 21, 1990 and continued through September 14, 1990. The East Fork trap was in operation from June 4, 1990 to September 14, 1990. Sawtooth's peak of the run occurred during the last week of June and first week of July (Appendix C1). East Fork's peak occurred during the third week of August (Appendix C2).

Sawtooth Hatchery trapped a total of 1,488 adult fish, of which 873 were males, 112 were jacks, and 503 were females (Table 2). One-third of the total run was released to spawn naturally above the weir. This included 390 males, 58 jacks, and 167 females (Table 3). The other two-thirds of the run was spawned at the hatchery. Tagging recoveries included 109 ad-clips, 23 LV clips, and 1 RV clip.

The East Fork facility trapped 145 adult fish, of which 103 were males, 12 were jacks, and 30 were females (Table 2). A total of 71 males, 7 jacks, and 10 females were released to spawn naturally above the weir (Table 3). East Fork had 7 ad-clipped fish return.

Sawtooth Hatchery had a male:female ratio of 67% males and 33% females. The East Fork's male:female ratio was 79% male and 21% female.

Coded wire tag recoveries showed 91 four-year-old fish returned to Sawtooth Hatchery. Seven snouts were taken from the East Fork, but were lost in transit from Stanley to Lewiston.

Adult Treatments

Sawtooth and East Fork adult chinook were injected with erythromycin phosphate at a rate of 20 mg active per kg of body weight. Injections were given in the dorsal sinus. The Sawtooth ponded adults were treated three times per week in a one-hour 175 ppm formalin flush. The East Fork ponded adults were treated with the same flush at a 100 ppm rate.

Prespawning Mortality

Sawtooth had 26 pre-spawning mortalities for a 3% mortality rate. A total of 9 males, 14 females, and 1 jack died prior to spawning at Sawtooth. East Fork lost 1 female for a 1.7% overall mortality rate.

CH90ST91

Table 1. Results of disease sampling.

Case #	Stock	Date	Data
Juvenile Samples			
91-153	EF SC	5/17/91	BK(FAT):12/18+ Bacty: +MAS
91-154	SAW SC	5/17/91	BK(FAT): 4/8+ Bacty: 0/4
91-191	EF SC	6/25/91	BK(FAT): 0/10 Viro: 0/10
			Bactv:0/8
91-192	SAW SC	6/25/91	BK(FAT): 0/10 Viro: 0/10
			Bactv: 0/8
91-210	SAW SC	7/23/91	BK(FAT): 0/60 Viro: 0/60
			PW: 0/65
91-211	EF SC	7/23/91	BK(FAT): 10/60+(TNTC)
			Viro: 0/60 PW: 0/60
91-213	RR SC	7/23/91	BK(FAT): 0/4 Bacty: 1/4+MAS
			Viro: 0/4
91-216	RR SC	7/26/91	Bacty: 2/12+BC
91-226	SAW SC	8/10/91	BK(FAT): 0/10 px: 0/10
			Viro: 0/10
91-227	SAW SC	8/10/91	BK(FAT): 5/11+ PX: 0/10
			Viro: 0/10
91-258	EF SC	9/5/91	BK(FAT): 1/12 Viro: 0/10
91-261	SAW SC	9/5/91	BK(FAT): 0/12 Viro: 0/10
91-292	RR SC	9/25/91	Viro: 0/60 BK(ELISA): 1/1+
			BK(FAT): 2/60+
91-336	SAW SC	10/28/91	BK(FAT): 0/12
91-337	SAW SC	10/28/91	BK(FAT): 0/12
92-03	SAW SC	1/9/92	Viro: 0/10 BK(ELISA): 1/1+
			<u>Bacty: 3/8+ Flexibacter spp.</u>
92-05	EF SC	1/9/92	<u>Bacty: 6/8+ Flexibacter spp.</u>
			Viro: 0/10 PW: 0/8
92-51	EF SC	2/27/91	BK(ELISA): 6/6+(5 high, 1 low)
			BK(FAT): 0/60 Viro: 0/60
92-52	SAW SC	2/27/91	BK(ELISA): 4/6+ (2 high, 2 low)
			BK(FAT): 3/60+ Viro: 0/60
Brood samples- chinook			
91-153	EF SC	5/17/90	BK: 12/18, 4/4 MAS
91-154	SAW SC	5/17/90	BK: 4/8, 0/4 BCTY
91-191	EF SC	6/25/90	BK:0/10, BACTY:0/8, VIRO:0/10
91-192	SAW SC	6/25/90	BK:0/10, BACTY:0/8, VIRO:0/10
Brood samples- steelhead			
91-89	EF STB	4/5/91	VIRO:0/4
91-90	SAW STA	4/8/91	VIRO:0/11
91-103	EF STB	4/15/91	VIRO:0/21, BK:0/8
91-104	SAW STA	4/16/91	VIRO:0/8, PC:0/5, PW:1/1
91-109	EF STB	4/18/91	VIRO&BK:0/8 KS, 0/4 OF, PC:0/12, PW:0/12
			VIRO&BK:0/3, PC:0/3, PW:1/1
91-110	SAW STA	4/19/91	BK:0/3, PC:0/8, VIRO: 0/8, PW:1/2
91-115	EF STB	4/22/91	VIRO:0/6, PW:1/2 pools, PC:0/6
91-116	SAW STA	4/23/91	BK:0/21, VIRO:0/21, PW:2/5, PC:0/21
91-129	SAW STA	4/26/91	BK:0/6, VIRO:0/6, PC:0/6, PW:1/1
91-130	EF STB	4/25/91	BK:0/6
91-135	SAW STA	4/30/91	BK:0/4, VE:0/30, VP:1/4
91-137	SAW STA	5/3/91	BK:0/12
91-142	SAW STA	5/7/91	BK:0/29, VE:0/56
91-145	EF STB	5/10/91	VE:0/1
91-146	SAW STA	5/10/91	

Table 2. Age class totals from trapped fish.

Sawtooth	Length (Fk)	Year class	Number
Fork	Males - < 64 cm	- 3 year old	112
	64 - 82 cm	- 4 year old	813
	> 82 cm	- 5 year old	60
	Females - < 82 cm	- 4 year old	399
	> 82 cm	- 5 year old	104 East
Fork	Males - < 64 cm	- 3 year old	12
	64 - 82 cm	- 4 year old	85
	> 82 cm	- 5 year old	18
	Females - < 82 cm	- 4 year old	21
	> 82 cm	- 5 year old	9

Table 3. Age class breakdown by released fish, brood year 1990.

Sawtooth	Length (Fk)	Year class	Number
	Males - < 64 cm-	3 year old -	58
	64 - 82 cm -	4 year old -	355
	> 82 cm	- 5 year old -	35
	Females - < 82 cm	- 4 year old -	134
	> 82 cm	- 5 year old -	33
East Fork			
	Males - < 64 cm	- 3 year old -	7
	64 - 82 cm -	4 year old -	64
	>82 cm	- 5 year old -	7
	Females - < 82 cm	- 4 year old -	8
	>82 cm	- 5 year old -	2

Spawning Operations

Sawtooth Hatchery spawned chinook 13 times: July 27; August 3, 7, 14, 17, 21, 24, 28, 31; September 4, 7, 11, and 14. East Fork spawned chinook 7 times: August 10, 16, 23, 27, 29; September 1, 6.

Sawtooth Hatchery spawned 318 females and 321 males (jacks were not differentiated from males). East Fork spawned 18 females and 38 males. One male was combined with each female's eggs at Sawtooth Hatchery. Two, and sometimes three, males were combined with each females's eggs at the East Fork.

Sawtooth took 1,431,360 green eggs (4,501 eggs per female). East Fork took 98,560 green eggs (5,476 eggs per female). These numbers were derived using the Von Bayer method of egg enumeration.

After fertilization, the eggs were rinsed with well water until all the sperm and blood was removed. A minimum 100 ppm Argentyne (10% iodine) solution was added to the eggs for one hour. The eggs were then put into Heath incubator trays, with one female per tray for BKD segregation. Twenty-seven females had a low incidence of BKD and 9 females had a high incidence (See Fish Health). All of these eggs were isolated from the production eggs.

Incubation

After water hardening in the minimum 100 ppm Argentyne solution, the green eggs were put in Heath trays at one female per tray. Each 8-tray Heath stack had 5 gpm of well water supplied to it. All incubated eggs were treated with a 1,667 ppm formalin bath for 15 minutes five times per week for fungal control.

Eggs were put away at one female per tray for BKD segregation. This averaged about 42 oz, or about 4,500 eggs per tray. No eggs were received from any other source.

Well temperatures dropped from 50°F to 41°F during the incubation period (Appendix G). The eggs eyed-up around 480 TU's. They were shocked around 500 TU's and hatched around 1,230 TU's.

Sawtooth green eggs eyed up at a 94.1% rate, yielding 1,346,350 eyed eggs (Appendix F). East Fork green eggs eyed up at a 91.3% rate, yielding 90,010 eyed eggs. The eyed eggs were shocked by putting the eggs in a half-full 3-gallon bucket of water, then pouring that bucket into a one quarter-full bucket of water from about three feet high. One day after shocking, the eggs were machine-picked using a Jenn-sorter model JH machine, which sorts and enumerates eggs. A day or two after machine-picking, the eyed eggs are hand-picked. The eggs are again hand-picked two weeks after machine-picking, then once again before swim-up.

Early Rearing

The swim-up fry were kept at a higher density during feed training (1.2 lbs/cubic ft) until all the fish were on feed. After all the fish were eating well, rearing volumes were increased and densities decreased to 0.15 lbs/per cubic ft. The fingerlings were moved to the final rearing raceways when densities began to approach 0.8 lbs/per cubic ft.

The swim-up fry were transferred from the Heath trays to epoxy-painted cement vats for early rearing in December through mid-January. The vats

contained PVC baffles every four feet. The vats are 4 ft wide x 3 ft deep x 40 ft long, with keyways to allow lengths of either 10 ft, 20 ft, or 40 ft, thus creating rearing volumes of 120, 240, or 480 cubic ft.

Starting flows for the swim-up fry were set at 20 gpm per vat. As the fish grew, the flows were increased to 110 gpm. Early rearing well water varied in temperature from 44°F at swim-up to 40°F when the fish were moved to the final rearing raceways (Appendix G).

All fry were started on Moore-Clark OMP IV feed with 10X pantothenic acid and vitamin C. After the initial mortality of those fish that did not learn to feed, there was no high incidence of mortality at any one time. Our normal drop-out did not occur, and sunburn lesions were seen on less than 1% of the fingerlings. All fish were fed a prophylactic treatment of Gallimycin-50 at a rate of 4.5 grams active/100 lbs of fish. A feed schedule is shown in Table 4.

This was the second year of rearing/density studies. Three vats were loaded with 30,000 fry, three vats were loaded with about 65,000 fry, and three vats were loaded with about 100,000 fry (control). This study began last year and will finish with BY 91.

The fish were transferred to the final rearing raceways around 140 fish per pound during late May and early June.

Final Rearing

The outside raceways are cement, measuring 12 ft wide x 2.3 ft deep x 100 ft long, yielding 2,700 cubic feet of rearing space. Starting densities outside averaged 0.05 pounds per cubic foot. The densities increased to 0.28 pounds per cubic foot before the fish were released.

Initial flows were set at 500 gpm per raceway and increased to 1,000 gpm during the heat of the summer. River water supplies the outside raceways, so daily temperatures fluctuate up to 19°F. Seasonal variances range from lows of 32°F in winter to 69°F in summer (Appendix G).

All outside fish were fed a diet of Moore-Clark OMP-IV with ten times normal vitamin C to prevent sunburn. All outside fish were fed a 21-day prophylactic treatment of Gallimycin-50 at a rate of 4.5 grams active/100 pounds of fish to prevent the onset of BED.

The only raceways experiencing above-normal mortality was an East Fork high BED segregated raceway and a Sawtooth high BED segregated raceway.

The density study initiated in the inside rearing vats was continued in the outside raceways. The ten times normal vitamin C did prevent the occurrence of sunburn. Sunburn was visible on about 1% of the outside fish.

In early June, the hatchery received 354,000 Rapid River stock fish to be reared for release into the Yankee Fork River.

The 1990 brood year chinook were fed 82,917 pounds of feed to 45,373 pounds of fish for a feed conversion of 1.83. This figure includes the East Fork group. Both groups are shown in the cost analysis in Appendix I.

Table 4. Feed schedule for Sawtooth Hatchery spring Chinook, brood year 1990.

fpp	%bw fed	time span
swim-up - 800	.035	12/15/90-1/15/91
800 - 500	.033	1/16 - 2/28
500 - 400	.028	3/1 - 3/15
400 - 350	.025	3/16 - 3/24
350 - 300	.023	3/25 - 4/1
300 - 250	.02	4/2 - 4/14
250 - 150	.022	4/15 - 6/1
150 - 110	.024	6/2 - 6/28
110 - 90	.028	6/29 - 7/4
90 - 50	.03	7/5 - 8/15
50 - 25	.028	8/16 - 9/25
25 - 21	.024	9/26 - 10/15
21 -	maintenance	10/15/91-3/15/92 (release)

Fish Marking

A majority of the chinook were marked during June 17-24, 1991 and September 17-25, 1991. About 300,000 fish were ad-clipped and given a CWT to fulfill Sawtooth Hatchery's requirement for the U.S./Canada treaty. Some fish were given an LV clip to identify them for the supplementation program. The freeze brands and PIT tags are to evaluate downriver migration. The Rapid River stock was given an RV clip to identify that stock. A summary of marking is shown in Table 5 and broken down further in Appendix J.

After an initial chlorine kill of around 3,600 fish, which resulted from a tagging trailer not being completely flushed out, tagging went very smoothly. An erythromycin treatment was attempted on the high-BED raceways after tagging was completed, but the water temperature was too cold for an effective dosage to be consumed by the fish.

Fish Distribution

Fish distribution for the 1990 brood year began in June of 1991 with the planting of some Rapid River chinook stock into the Yankee Fork (Appendix E). The remaining Rapid River stock were released into the Yankee Fork during late September of 1991. About 1,500 PIT-tagged fish were released September 20, 1991 below the Sawtooth weir. A volitional release was initiated on March 9, 1992 for the Sawtooth chinook. Approximately two-thirds of the smolts emigrated from the raceways before pulling the boards and flushing the remaining fish into the river on March 13, 1992 (Appendix E).

The East Fork chinook smolts were trucked to the pool below the velocity barrier on March 31, 1992. The smolts moved downstream within three days. A summary of all the smolt releases is shown in Appendix E.

Table 5. Summary of marked chinook, brood year 1990.

	Sawtooth	East Fork	Rapid River
Total CWT	422,072	78,255	0
CWT + PIT	7,264	0	0
LV clip only	538,924	0	0
LV + FB	61,582	0	0
LV + PIT	1,500	0	0
RV only	0	0	304,068
	1,024,078	78,255	304,068

1991 STEELHEAD

ABSTRACT

The Sawtooth trap and weir were put into operation on February 28, 1991 and closed May 14, 1991. A total of 261 adult steelhead were trapped at the Sawtooth weir, which includes 213 males and 48 females. A total of 91 steelhead were released to spawn naturally above the weir, which included 76 males (8 wild) and 15 females (4 wild). Prespawning mortality at Sawtooth Hatchery totaled three fish (all males).

Spawning began on April 8, 1991 and continued through April 25, 1991, with eight spawning days occurring. Thirty-three females were spawned at Sawtooth, yielding 132,630 green eggs for an average fecundity of 4,019 eggs per female. These green eggs resulted in 116,430 eyed eggs for an eye-up percentage of 87.79%. A total of 110,390 of these were shipped to Hagerman National Fish Hatchery for rearing, while 6,040 IPN-positive eyed eggs were shipped to Magic Valley Hatchery.

The East Fork velocity barrier was put into operation March 1, 1991. Trapping began on March 27, 1991 and ran through May 10, 1991. A total of 119 adult steelhead were trapped, which included 86 males and 33 females. Thirty-five males (12 wild) and 16 females (9 wild) were released above the velocity barrier to spawn naturally. Twelve females and four males were donated by anglers from I.S.S.U., but most were spawned out already. There was no prespawning mortality.

Spawning operations began on April 8, 1991 and continued through April 25, 1991, with six spawning days occurring. The East Fork facility spawned 25 females, yielding 100,920 green eggs for an average fecundity of 4,037 eggs per female. These green eggs resulted in 87,500 eyed eggs for an eye-up percentage of 86.7%. All of these eggs were shipped to Magic Valley Hatchery for rearing.

An additional 810,890 green eggs from Pahsimeroi Hatchery were incubated at Sawtooth. These eggs eyed-up at a 83.6% rate, yielding 677,706 eyed-eggs. Hagerman National Hatchery received 606,070 of these eggs, while 71,630 IPN-positive eggs were shipped to Magic Valley Hatchery for rearing.

The smolts raised from these eyed-eggs were released at Sawtooth and East Fork facilities the spring of 1992. A total of 103,238 Sawtooth and 420,905 Pahsimeroi stock were released at Sawtooth Hatchery from Hagerman National Hatchery, while 117,300 Pahsimeroi stock from Magic Valley were released at Sawtooth Hatchery. Another 956,400 Dworshak "B" steelhead and 84,800 East Fork stock smolts were released at the East Fork facility.

Authors:

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Fish Hatchery Superintendent III

Phil Coonts
Fish Hatchery Superintendent I

FISH PRODUCTION

Steelhead Adult Collection

The Sawtooth weir was put into operation on February 28, 1991, thus commencing the steelhead trapping season, and continued through May 14, 1991. The East Fork trap was put into operation March 27, 1991 and ran through May 10, 1991. The peak of the run at both locations occurred the third week of April (Appendix C3 and C4).

Sawtooth Hatchery trapped a total of 261 adult fish, which included 213 males and 48 females (Table 6). Nine of these had LV clips and two of these nine had tags. A total of 76 males (8 wild) and 15 females (4 wild) were released above the weir to spawn naturally. All wild fish were released, plus one-third of the total run. The other two-thirds of the run was spawned at the hatchery.

The East Fork facility trapped 119 adult fish, of which 86 were males and 33 were females. A total of 35 males (12 wild) and 16 females (9 wild) were released above the velocity barrier to spawn naturally (Table 7). The other two-thirds of the run was spawned at the facility. East Fork had 10 clipped fish return, with 6 of those fish having tags. The length frequency distribution of steelhead from Sawtooth and the East Fork is shown in Appendix A.

Sawtooth had a male:female ratio of 82% males and 18% females. The East Fork's male:female ratio was 72% male and 28% female.

Using Kent Ball's (IDFG Anadromous Researcher) lengths for 1 and 2 ocean fish, steelhead returns by year class and sex are shown in Table 6.

Very little CWT information was recovered. Sawtooth had two CWT fish, each 3 years old. The East Fork had six CWT recoveries. This included four 3-year-olds and two 4-year-old fish.

Released steelhead by adult year class and sex are shown in Table 7.

Adult Treatments

The returning adults at Sawtooth Hatchery and East Fork Satellite are not treated or injected with any type of drugs or chemicals prior to spawning.

Prespawning Mortality

Sawtooth Hatchery had three male and no female adults die before being spawned. The East Fork facility had no pre-spawning mortality.

Spawning Operations

Sawtooth Hatchery spawned steelhead on eight different days: April 9, 16, 19, 23, 26, 30; May 3 and 7, 1991. Spawning took place five times at the East Fork, on April 8, 15, 18, 22, and 25, 1991. Both facilities used two males per female, pooling the males' sperm together, then pouring it onto the eggs.

Table 6. Steelhead returns by year class' and sex,
brood year 1991.

Sawtooth

2 year old males - - - 189

3 or 4 year old males - 24

213 males

2 year old females - - 29

3 or 4 year old females 19

48 females

East Fork

2 year old males - - - 43

3 or 4 year old males - 43

86 males

2 year old females - - 4

3 or 4 year old females- 29

33 females

'These figures are based on Kent Ball's criteria for aging
steelhead, as described in Table 8.

Table 7. Released steelhead by year class and sex, brood year 1991.

<u>Sawtooth</u>			
Males - 2 year old -	64	Females - 2 year old -	10
3 or 4 year old -	12	3 or 4 year old -	5
	76		15
<u>East Fork</u>			
Males - 2 year old -	14	Females - 2 year old -	2
3 or 4 year old -	21	3 or 4 year old -	14
	35		16

Table 8. Criteria for aging steelhead, from Kent Ball, IDFG.

"A" male -	< 68 cm - 2 year old
	> 68 cm - 3 or 4 year old
"A" female -	< 65 cm - 2 year old
	> 65 cm - 3 or 4 year old
"B" male -	< 73 cm - 2 year old
	> 73 cm - 3 or 4 year old
"B" female -	< 68 cm - 2 year old
	> 68 cm - 3 or 4 year old

At Sawtooth, 71 fish were spawned, of which 33 were females. At the East Fork, 56 fish were spawned of which 25 were females. Using the Von Bayer method of egg enumeration, it was calculated that 132,630 green eggs were collected from the Sawtooth fish (4,019/female) and 100,920 green eggs were taken from the East Fork fish (4,037/female).

After fertilization, the eggs are rinsed with well water until all the sperm and/or blood is removed. Next, a minimum 100 ppm Argentyne (10% iodine) solution is added to the eggs for one hour, then the eggs are put into Heath trays. Two females' eggs were pooled into each incubator tray. After receiving the viral test results, viral positive eggs are isolated from viral-free eggs.

Incubation

After hardening in an Argentyne solution, the green eggs were put away at two females per Heath tray. Incubation trays were loaded with two females' eggs. Water flow was set at 4 gpm of well water per stack and increased to 5 at eye-up.

An additional 810,890 green eggs were received from Pahsimeroi spawning operations and incubated at Sawtooth. These eggs were incubated at two females per Heath tray.

All incubated eggs were treated with a 1,667 ppm 15-minute formalin bath five times per week for fungal control. Sawtooth's eggs eyed up at 87.8%, yielding 116,430 eyed eggs (Appendix F). East Fork's eggs eyed up at 86.7%, yielding 87,500 eyed eggs. Pahsimeroi eggs incubated at Sawtooth eyed up at 83.6%, resulting in 677,700 eyed eggs.

Well temperatures varied from 38°F at the beginning of incubation to 44°F at the end of incubation. Seven TU's per day was the average during the incubation period. Eye-up occurred around 300 TU's, and the eggs were shocked at 310 TU's.

The eggs were shocked by putting the eggs in a half-full 3-gallon bucket of water, then pouring them into a quarter-full bucket of water from about 3 feet high. One day after shocking, the eggs are machine-picked, using a Jenn Sorter model JH machine, which picks and enumerates eggs. A day or two after machine picking, the eyed-eggs are hand-picked before being transferred to the rearing hatcheries. The eggs are loaded at 50,000 per 48-quart cooler of well water with two inches of ice added, then the cooler is strapped shut and shipped to the rearing hatcheries.

Acclimation

While the smolts were being acclimated at Sawtooth during March and early April, there was a very noticeable difference in mortality among the different raceways. The Hagerman fish had a higher initial mortality after hauling and sustained a higher mortality over a longer period than any of the Magic Valley fish. This was apparently due to the different fish pumps used to load the smolts and the different crews crowding the fish and operating the pumps.

Fish Marking

Fish marking was completed at the rearing hatcheries and is shown in Appendix J.

The only mortality that occurred with releasing the above fish was caused by the crowding screens, or fish being stepped on. The release went very smoothly below the Sawtooth weir. Very little mortality was noted in the hole below the East Fork velocity barrier. No more than 300 fish were seen dead in the hole after hauling was completed. Around 50 dead fish were counted in the river within a quarter-mile downstream from the release site.

CONCLUSIONS/RECOMMENDATIONS

East Fork Trap

The East Fork of the Salmon River steelhead and chinook runs have been insufficient to meet egg needs or escapement. With the installation of the temporary lower weir at the mouth of the East Fork during the 1992 steelhead run, it was apparent that some fish drop-out to spawn before reaching the permanent trapping facility 20 miles upstream.

Because the tribal fishery exists on the East Fork, a lower temporary weir would eliminate this fishery unless a specified amount of fish were released above it. Given the problems associated with the placement of this lower weir, it is imperative that if we put it in place, we need some major cooperation from management, the region, and enforcement personnel.

Steelhead Acclimation

The acclimation of steelhead smolts in Sawtooth raceways went very smoothly. It was valuable to enumerate the actual mortality in hauling large numbers of fish and see the factors that need to be considered in crowding and pumping fish.

If the acclimated fish return at a significant rate above normal return rates, the East Fork site should have ponds built on site to acclimate the steelhead and chinook smolts.

A P P E N D I C E S

CH9OST91

Appendix A1. Sawtooth chinook length frequency distribution, 1990.

	Fish trapped	Males	Females	Length (in)	Length (cm)
	2	2	0	14.91	38
	1	1	0	15.75	40
	2	2	0	16.54	42
	3	3	0	17.32	44
	3	3	0	18.11	46
	7	7	0	18.91	48
	2	2	0	19.69	50
	6	6	0	21.26	52
	2	2	0	21.67	54
	4	4	0	22.05	56
	17	16	1	22.83	58
	10	9	1	23.62	60
	24	23	1	24.41	62
	37	32	5	25.19	64
	47	44	3	25.98	66
	109	88.	21	26.77	68
	108	74	34	27.56	70
	169	125	44	28.35	72
	206	135	71	29.13	74
	203	141	62	29.92	76
	170	102	68	30.71	78
	102	54	48	31.51	80
	90	50	40	32.28	82
	53	26	27	33.07	84
	32	13	19	33.85	86
	26	8	18	34.65	88
	16	0	16	35.43	90
	11	4	7	36.22	92
	13	2	11	37.01	94
	8	3	5	37.81	96
	2	1	1	38.58	98
	0	0	0	39.37	100
	0	0	0	40.16	102
	3	3	0	20.95	104
Totals	1,488	985	503		

APPS

Appendix A2. East Fork chinook length frequency distribution, brood year 1990.

	Fish trapped	Males	Females	Length (in)	Length (cm)
	0	0	0	14.91	38
	0	0	0	15.75	40
	0	0	0	16.54	42
	0	0	0	17.32	44
	0	0	0	18.11	46
	1	1	0	18.91	48
	0	0	0	19.69	50
	0	0	0	21.26	52
	1	1	0	21.67	54
	0	0	0	22.05	56
	3	3	0	22.83	58
	1	1	0	23.62	60
	2	2	0	24.41	62
	5	4	1	25.19	64
	9	8	1	25.98	66
	13	11	2	26.77	68
	11	10	1	27.56	70
	14	12	2	28.35	72
	12	9	3	29.13	74
	14	10	4	29.92	76
	17	14	3	30.71	78
	9	7	2	31.51	80
	6	4	2	32.28	82
	6	4	2	33.07	84
	2	2	0	33.85	86
	1	0	1	34.65	88
	1	1	0	35.43	90
	7	5	2	36.22	92
	2	0	2	37.01	94
	4	2	2	37.81	96
	1	1	0	38.58	98
	1	1	0	39.37	100
	1	1	0	40.16	102
	1	1	0	40.94	104
	0	0	0	41.73	106
	0	0	0	42.52	108
Totals	145	115	30		

Appendix A3. Length frequency distribution of Sawtooth steelhead, brood year 1991.

Length (cm)	Hatchery males	Wild males	Hatchery females	Wild females	Total
51					
52	1		1		2
53			2		2
54	5		2		7
55	10		0		10
56	19		3		22
57	23		3		26
58	30		6	2	38
59	23		1		24
60	19		6		25
61	19		2		21
62	14		1		15
63	5		0		5
64	5		0		5
65	9		0		9
66	2		2		4
67	2		1		3
68	3		1	1	5
69	4		1		5
70	2		1		3
71	2	1	4		7
72	2		2		4
73	0	1	1		2
74	1		2		3
75	2	1	0	1	4
76	2	1	2		5
77	0				0
78	0				0
79	0	2			2
80	1				1
81		1			1
82					
83					
84					
85					
86		1			1
Totals	205	8	44	4	261

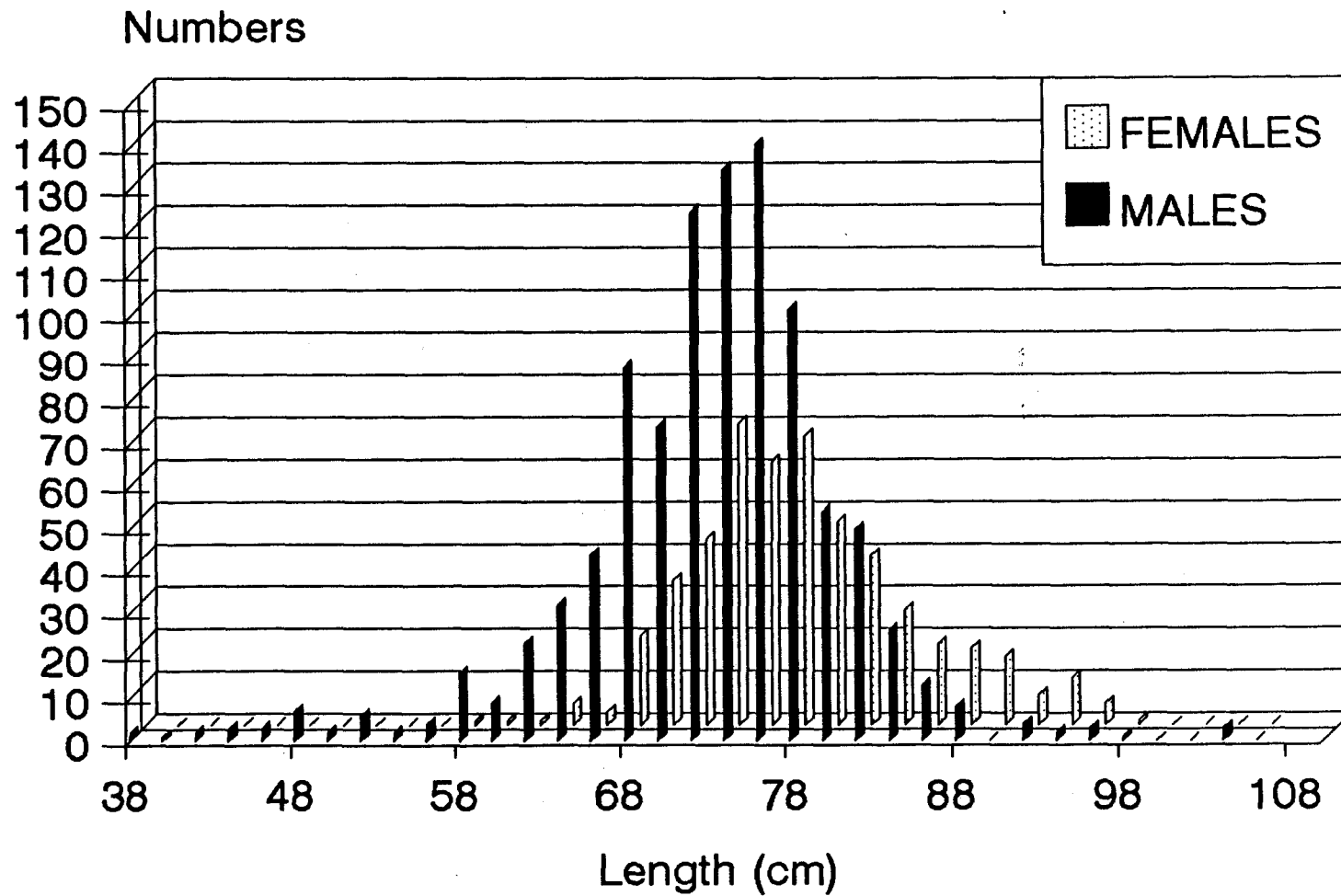
Appendix A4. Length frequency distribution of East Fork steelhead, brood year 1991.

Length (cm)	Hatchery males	Wild males	Hatchery females	Wild females	Total
44		1			1
45					
46		1			1
47		1			1
48					
49					
50					
51					
52					
53					
54	1				1
55					
56					
57				1	1
58	0	2	1	1	4
59	1	1			2
60	3				3
61	1				1
62	5	1	1		7
63	7				7
64	5	1			6
65	2				2
66	1	1			2
67	2				2
68					
69					
70	1		2		3
71	1		1		2
72	2		3		5
73	2		2	1	5
74			1		1
75	3		3	1	7
76	5		1		6
77	2	1	3	1	7
78	4		1	1	6
79	7		1		8
80	7		1	2	10
81	6				6
82		1	1	1	3
83	2				2
84	1				1
85		1			1
86	2		1		3
87	1				1
88					
89			1		1
Totals	74	12	24	9	119

SAWTOOTH CHINOOK LENGTH FREQUENCY DISTRIBUTION

1990

n=1488

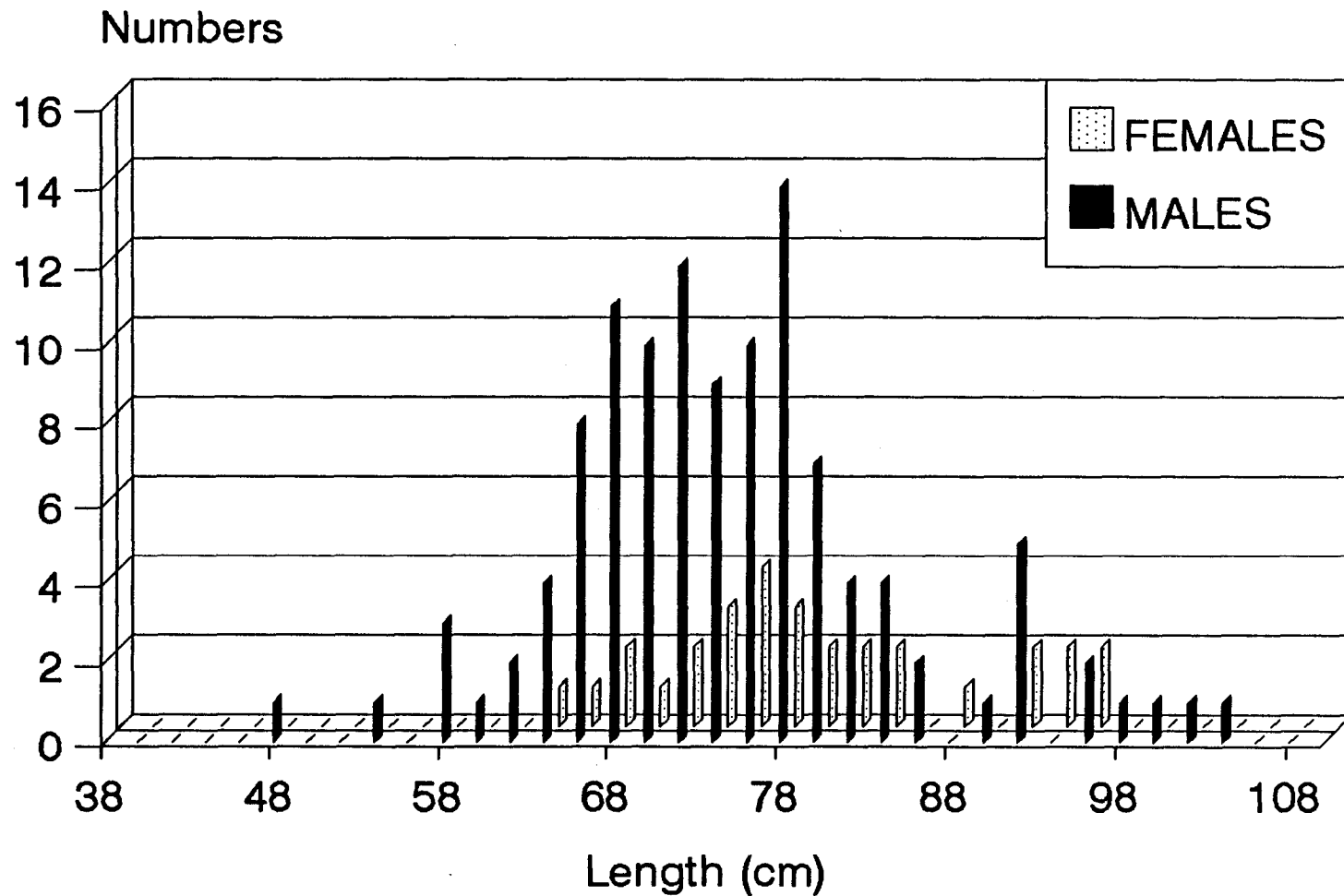


Appendix B1. Sawtooth chinook length frequency distribution, 1990.

EAST FORK CHINOOK LENGTH FREQUENCY DISTRIBUTION

1990

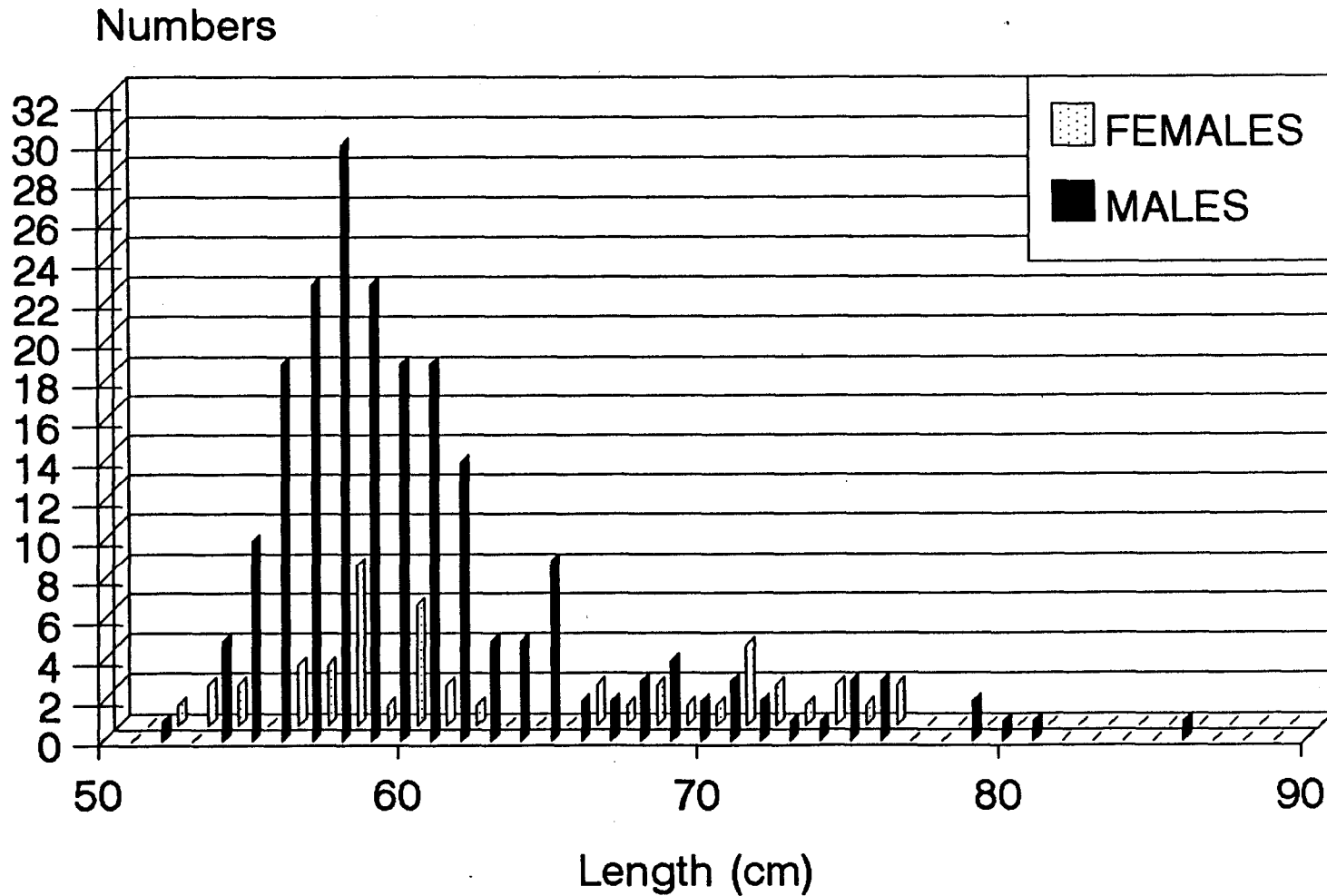
n=145



Appendix B2. East Fork chinook length frequency distribution, 1990.

SAWTOOTH STEELHEAD LENGTH FREQUENCY DISTRIBUTION

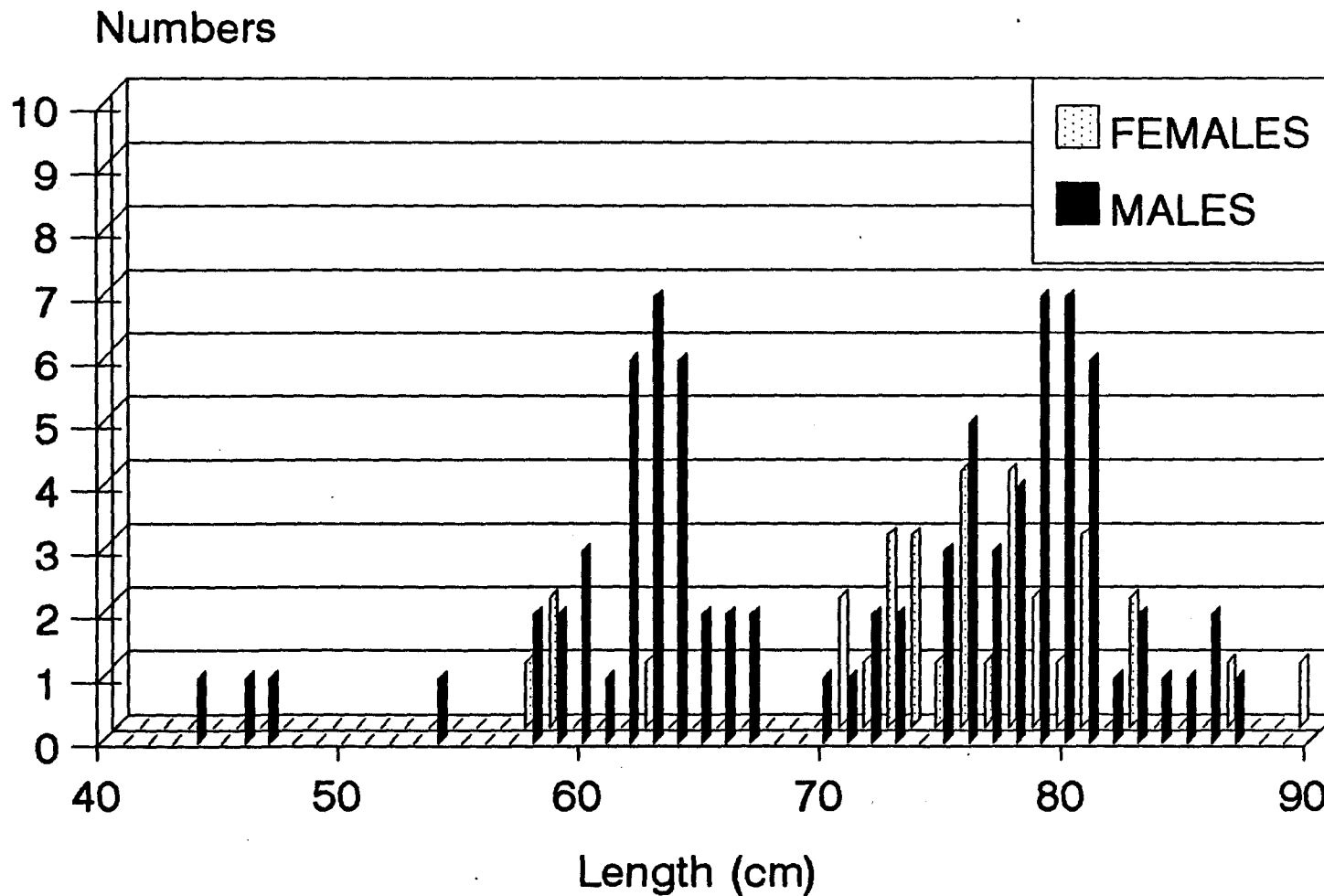
1991 n=261



Appendix B3. Sawtooth steelhead length frequency distribution, 1991.

EAST FORK STEELHEAD LENGTH FREQUENCY DISTRIBUTION

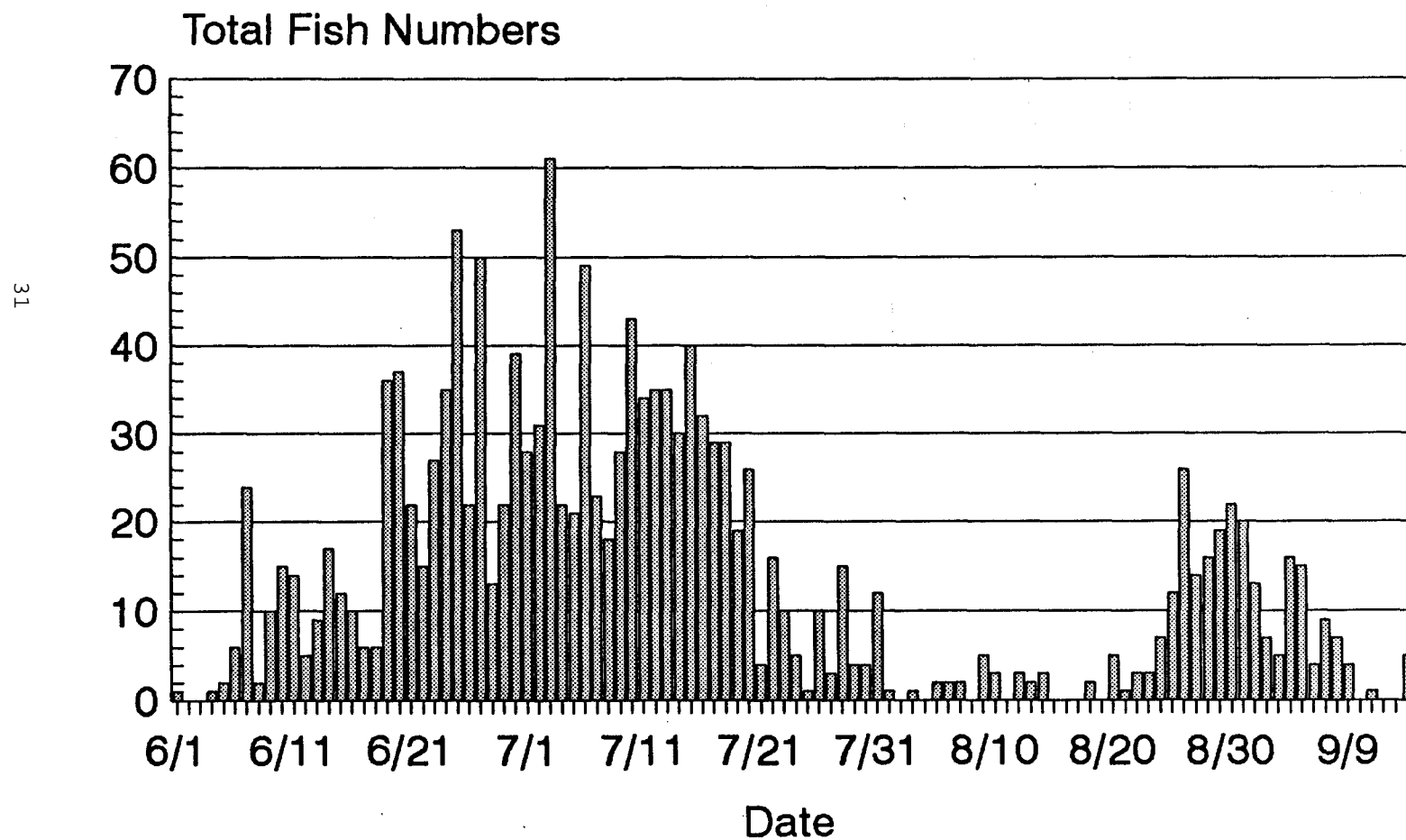
1991 n=119



Appendix B4. East Fork steelhead length frequency distribution, 1991.

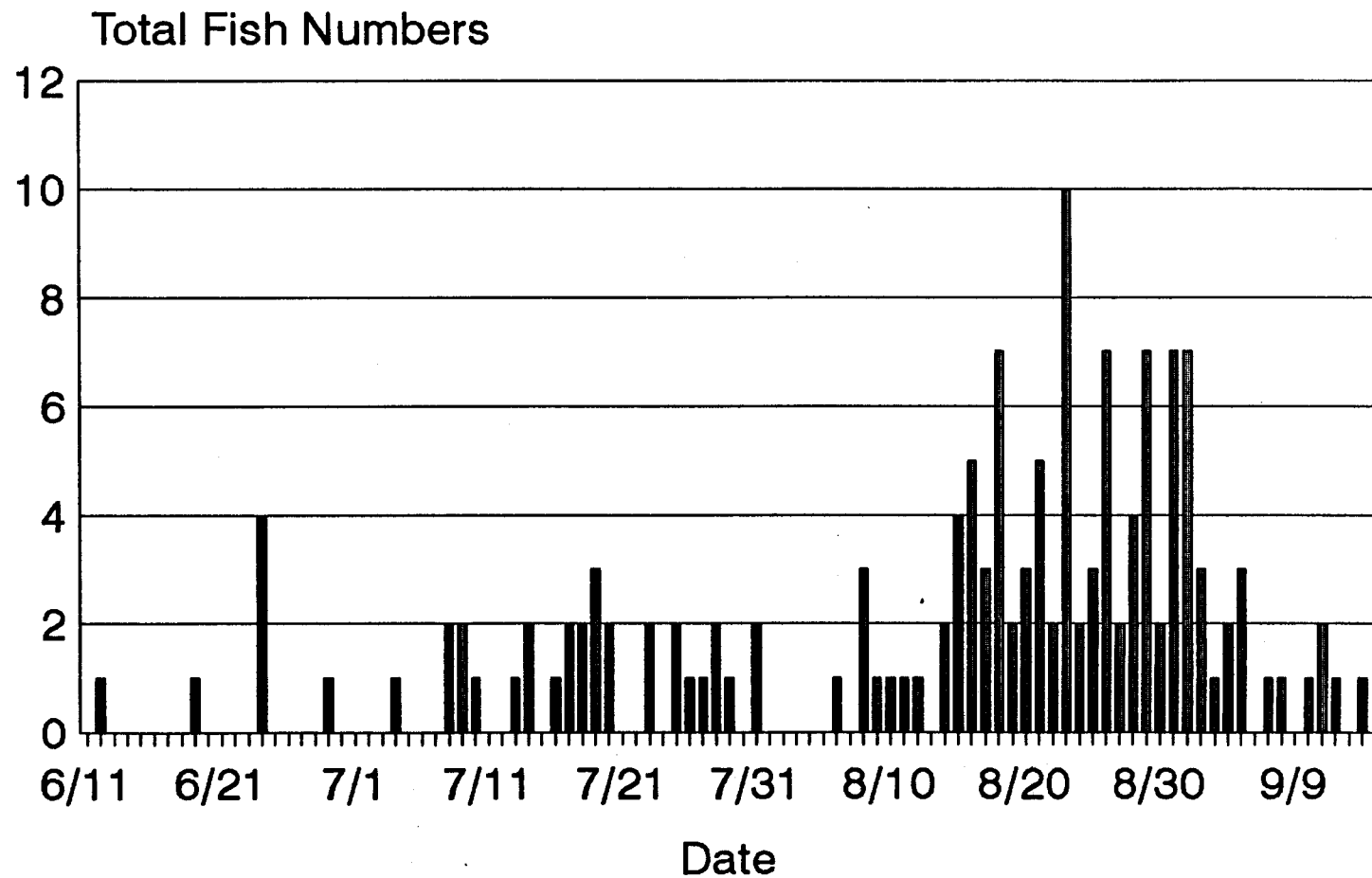
1990 SAWTOOTH CHINOOK SALMON

RUN TIMING $n=1,488$



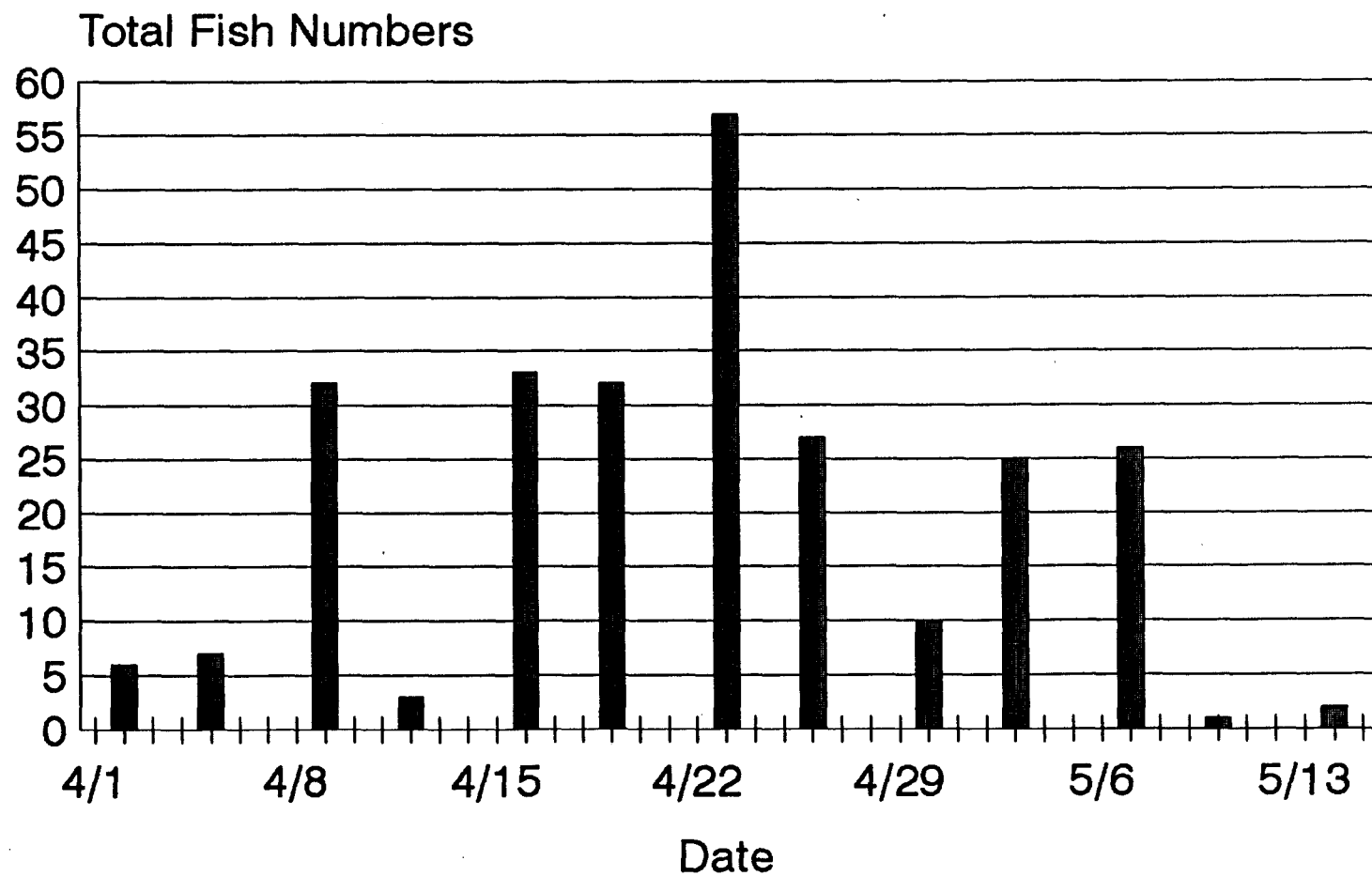
Appendix C1. Sawtooth chinook salmon run timing, 1990.

1990 EAST FORK CHINOOK SALMON RUN TIMING n=145



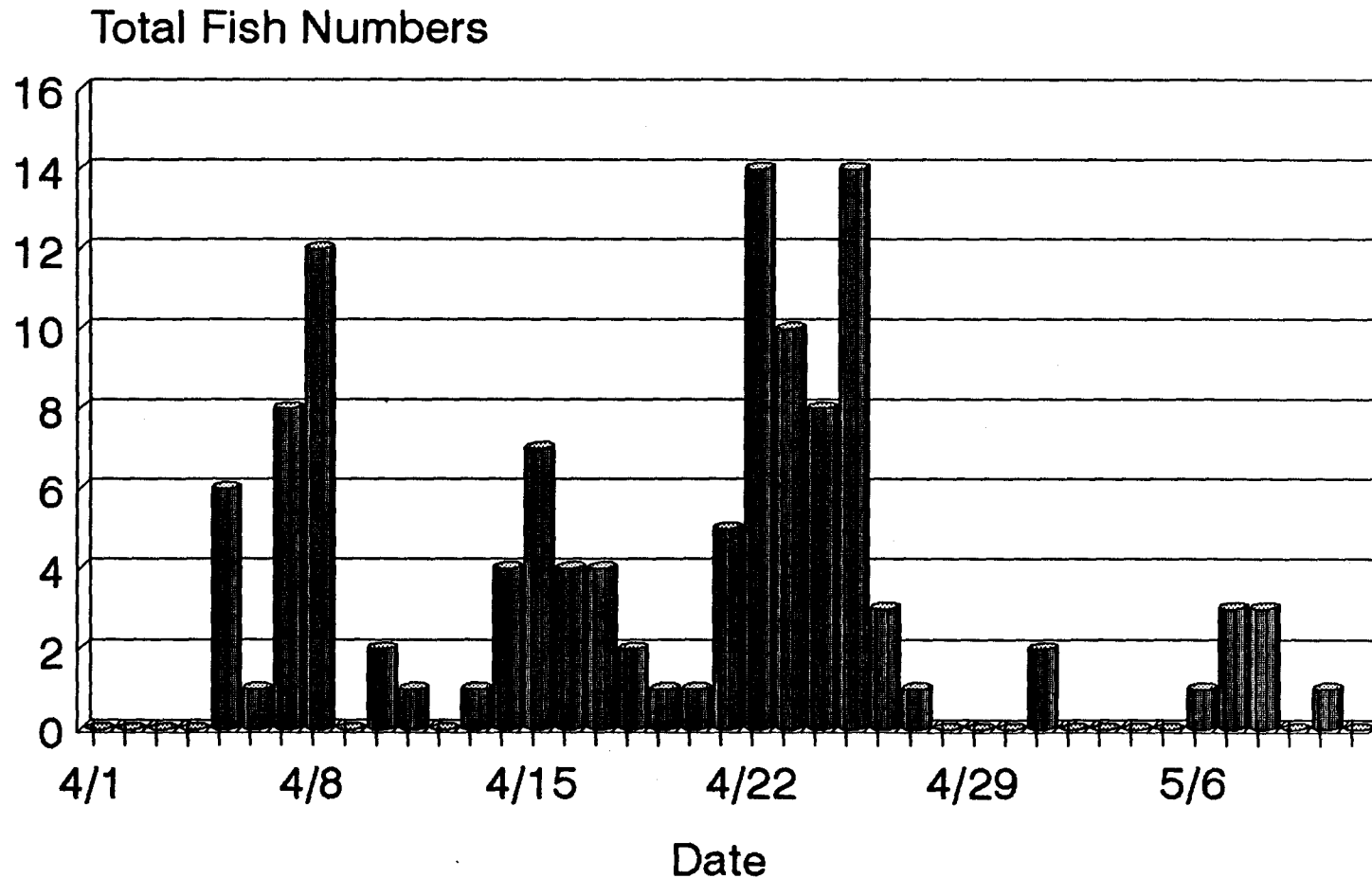
Appendix C2. East Fork chinook salmon run timing, 1990.

1991 SAWTOOTH STEELHEAD RUN TIMING n=261



Appendix C3. Sawtooth steelhead run timing, 1991.

1991 EAST FORK STEELHEAD RUN TIMING n=119



Appendix C4. East Fork steelhead run timing, 1991.

Appendix D. Sawtooth Hatchery chinook smolt releases and adult returns, 1979-1989.

Brood Year	Release Year	Number Released	Adult Returns ^{a,b}			Total Returns	Percent
			3-year	4-year	5-year		
1979	1981	None	-	-	291	-	inc.
1980	1982	None	17	66	165	248	inc.
1981	1983	185,375	49	1,182	796	2,027	1.08
1982	1984	230,550	292	922	875	2,086	.91
1982	1985	420,060	51	452	1,318	1,821	.43
1984	1986	347,484	17	86	190	293	.08
1985	1987	1,185,061	80	286	164	530	.05
1986	87-88	1,705,500	412	1,212	297	1,921	.11
1987	88-89	2,092,000	112	201	63	376	.02
1988	89-90	1,895,600	68	496	(1993)	-	inc.
1989	90-91	652,600	45	(1993)	(1994)	-	inc.

East Fork Chinook Smolt Releases and Adult Returns

1979	1981	-	-	-	69	69	inc.
1980	1982	-	-	36	59	85	inc.
1983	1983	-	22	193	102	317	inc.

^aAge classes based upon the following lengths:

3-yr-old: ≤ 64 cm

4-yr-old: 64 to 82 cm

5-yr-old: >82 cm

^bAdult returns include an unknown number of natural fish.

Appendix E. Smolt distribution in the Salmon River and tributaries.

<u>Hatchery</u> <u>Rearing</u>	<u>Destination</u>	<u>Weight</u>	<u>Number</u> <u>per lb</u>	<u>Number</u> <u>released</u>
<u>CHINOOK</u>				
Sawtooth	Sawtooth weir	34	44.0	1,496
Sawtooth	Sawtooth weir	42,115	30.2	1,271,904
Sawtooth	East Fork weir	3,224	24.6	79,300
Rapid River	Yankee Fork	250	202.0	50,500
Rapid River	Yankee Fork	4,472	68.0	303,800
Totals		50,095		1,707,000
<u>STEELHEAD</u>				
Hagerman Nat.	Sawtooth weir	22,940	4.5	103,238
Hagerman Nat.	Sawtooth weir	89,550	4.7	420,905
Magic Valley	Sawtooth weir	24,960	4.7	117,300
Magic Valley	East Fork weir	18,845	4.5	84,800
Magic Valley	East Fork weir	212,500	4.5	956,260
Totals		368,795	4.6	1,682,503

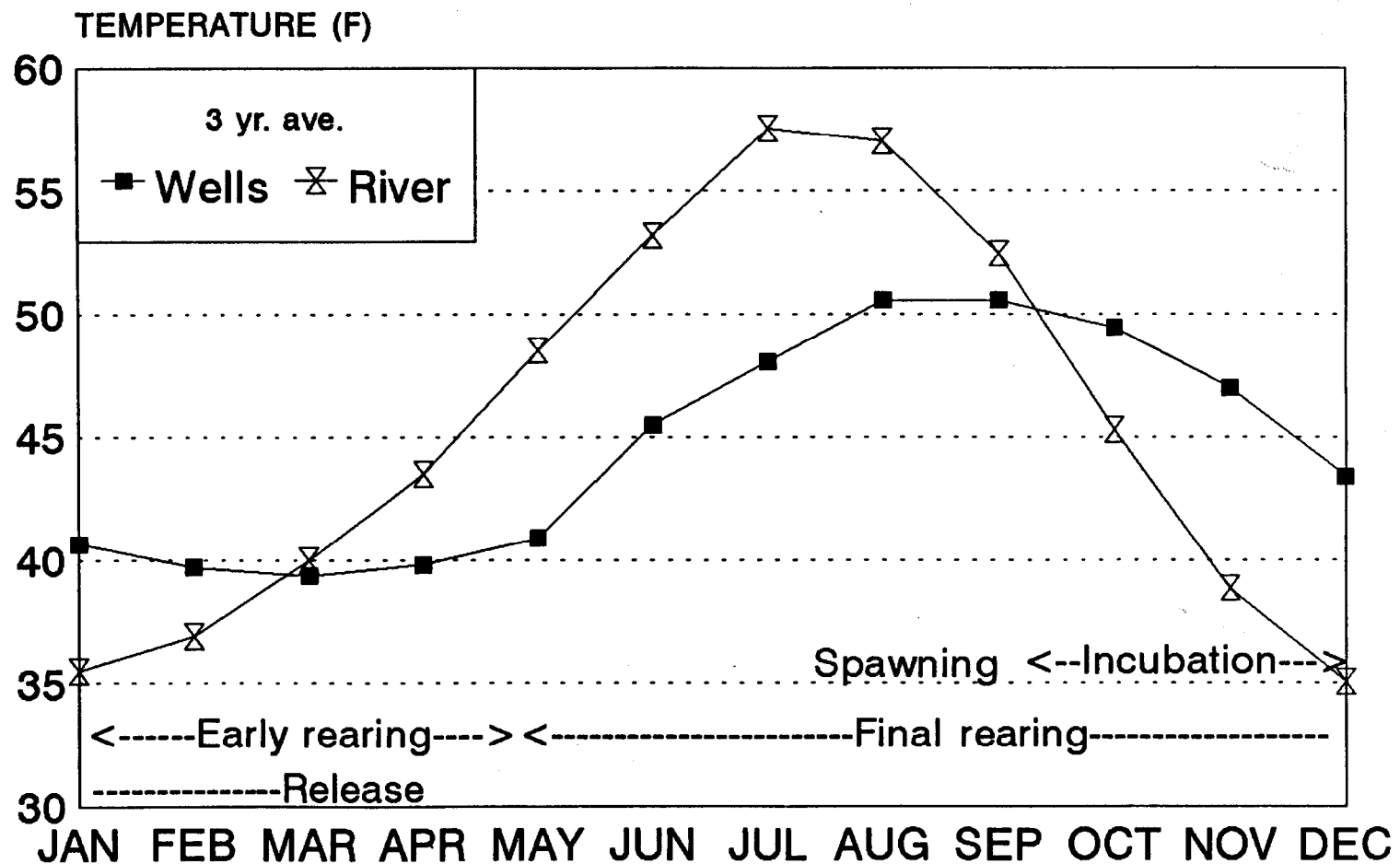
Appendix F. Survival table for chinook (BY 90) and steelhead (BY 91) from green eggs to released smolts, at Sawtooth and East Fork sites.

Green egg number	Eyed egg number	Percent survival	Released smolts	Percent survival from Green
CHINOOK				
Sawtooth fish				
1,431,360	1,346,350	94.1	1,271,904	88.9
East Fork fish				
98,560	90,010	91.3	79,300	80.5
Totals				
1,529,920	1,436,360	93.9	1,351,204	88.3
STEELHEAD				
Sawtooth fish				
132,630	116,430	87.8	103,238	77.8
East Fork fish				
100,920	87,500	86.7	84,800	84.0
Pahsimeroi				
810,890	677,706	83.6	538,205	66.4
Totals				
1,044,440	881,636	84.4	726,243	69.5

^aReared at other hatcheries.

SAWTOOTH FISH HATCHERY

WELL VS. RIVER TEMPERATURES, 1990-92.



Appendix H. Water quality analysis' of the Salmon River.

Nutrients	mg/L
T. Ammonia as N	0.045
T. NO ₂ + NO ₃ as N	0.088
T. Kjeldahl Nitrogen as N	0.26
T. Phosphorus as P	0.02
Ortho Phosphate as P	<.003
Minerals	mg/L
Sp. Conductance (umhos/cm)	135
Hardness as CaCO ₃	62
T. Alkalinity as CaCO ₃	63
Bicarbonate Alk. as CaCO ₃	63
Calcium	20.8
Magnesium	1.8
Sodium	3.8
Potassium	<1
Fluoride	0.58
Sulphate as SO ₄	<6
Total Metals	ug/L
Arsenic, Total	<10
Boron, Total	1
Cadmium, Total	<1
Chromium, +6	<50
Chromium, Total	<50
Copper, Total	<10
Iron, Total	120
Lead, Total	<50
Manganese, Total	10
Mercury, Total	<.5
Nickel, Total	<50
Silver, Total	<1
Zinc, Total	<1
Miscellaneous	
Turbidity (NTU)	1.8
pH (SU)	8.1
Total Cyanide (mg/L)	<.005
Total Residue	97

*From 9/10/85 sample taken from river; results of 1992 sample will be included in next years brood year report.

Appendix I. Production cost table (includes chinook brood year 1990 and steelhead brood year 1991).

Number	Lbs of feed	Cost of feed	Lbs of fish	Conversion	Total cost	Cost per 1,000	Cost per lb
CHINOOK							
			Sawtooth				
1,273,400	78,326	\$49,849.6	42,149	1.86	\$435,240	\$341.8	\$10.3
			East Fork				
79,300	4,591	\$2,901.3	3,224	1.42	\$100,440	\$1,266.6	\$31.2
STEELHEAD							
1,044,440	none	none	881,636	NA	\$133,920	\$151.9	NA
*Budget less capital outlay.							

Appendix J. Summary of smolt releases and marks.

Spring chinook					
Date	# fish	Mark/		# fish	Release
tagged	marked	code	Purpose	released	site
SAWTOOTH	53,260	Ad-10-40-11	US/CAN-HD	52,561	Saw
6/20/91					
6/24/91	53,961	Ad-10-40-10	US/CAN-HD	53,115	Saw
6/22/91	53,558	Ad-10-40-09	US/CAN-HD	52,943	Saw
6/24/91	53,930	Ad-10-40-04	US/CAN-MD	53,270	Saw
6/21/91	55,636	Ad-10-40-03	US/CAN-MD	55,186	Saw
6/22/91	54,221	Ad-10-40-05	US/CAN-MD	53,753	Saw
6/22/91	16,458	Ad-10-41-57	US/CAN-LD	16,308	Saw
6/22/91	16,041	Ad-10-41-56	US/CAN-LD	15,874	Saw
6/23/91	16,659	Ad-10-41-59	US/CAN-LD	16,499	Saw
9/23-24/91	20,477	LV-FB-LAT-1	Water Budg	20,195	Saw
9/25/91	20,600	LV-FB-LAT-2	Water Budg	20,532	Saw
9/27/91	20,505	LV-FB-LAT-3	Water Budg	20,444	Saw
6/23/91	16,642	Ad-10-41-58	US/CAN-LD	16,465	Saw
6/19/91	15,986	Ad-10-41-55	US/CAN-LD	15,866	Saw
6/19/91	15,720	Ad-10-41-54	US/CAN-LD	15,599	Saw
9/17-22/91	304,068	RV only	Yan Fk ID	303,800	Y. Fork
9/17-25/91	538,924	LV only	Hatch/Wild	537,312	Saw
9/17-20/91	1,500	LV-PIT	Spec.Study	1,496	Saw
9/17-23/91	7,264	CWT-PIT	Spec.Study	7,187	Saw
	1,328,146			1,266,823	

EAST FORK

9/24/91	7,625	Ad-10-43-10	EF eval.	7,200	E. Fork
9/23/91	16,424	Ad-10-42-13	EF eval.	16,100	E. Fork
9/22-24/91	54,206	Ad-10-40-06	EF eval.	53,494	E. Fork
	78,255			76,794	

Steelhead							
Date	Rearing	Number	Marks	Stock	fpp	Release	Purpose
Marked	Hatchery					site	
Sawtooth Stock							
11/91	HNFH	18,031	104421 LV	Pah A	4.7	Sawtooth	Accli.
11/91	HNFH	19,038	104422 LV	Pah A	4.7	Sawtooth	Accli.
11/91	HNFH	20,377	104423 LV	Pah A	4.7	Sawtooth	Accli.
11/91	HNFH	362,962	AD	Pah A	4.7	Sawtooth	Accli.
11/91	HNFH	103,238	AD	Saw A	4.5	Sawtooth	Accli.
11/91	HNFH	497	PIT	Pah A	4.7	Sawtooth	passage
11/91	MV	117,300	AD	Pah A	4.7	Sawtooth	Accli.
		641,443					
East Fork Stock							
4/92	MV	21,568	104419	Dwor B	4.5	E.F.	Contri.
4/92	MV	912,918	None	Dwor B	4.5	E.F.	Contri.
4/92	MV	20,821	104420	E.Fk B	4.5	E.F.	Contri.
4/92	MV	63,979	None	E.Fk B	4.5	E.F.	Contri.
		1,041,057					


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